

# **Identification of Barriers to Munitions Detection Technology Transfer**

## **Unexploded Ordnance Wide Area Assessment**

**September 2008**

Jon Horin  
Robert S. Wassmann

<b>Customer:</b>	SERDP/ESTCP	<b>Contract No.:</b>	FA8903-04-D-8715
<b>Noblis Dept. No.:</b>	H300	<b>Project No.:</b>	Task Order 085



Falls Church, Virginia

<b>Report Documentation Page</b>			Form Approved OMB No. 0704-0188					
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1. REPORT DATE <b>SEP 2008</b>	2. REPORT TYPE	3. DATES COVERED <b>00-00-2008 to 00-00-2008</b>						
<b>4. TITLE AND SUBTITLE</b> <b>Identification of Barriers to Munitions Detection Technology Transfer: Unexploded Ordnance Wide Area Assessment</b>			5a. CONTRACT NUMBER					
			5b. GRANT NUMBER					
			5c. PROGRAM ELEMENT NUMBER					
<b>6. AUTHOR(S)</b>			5d. PROJECT NUMBER					
			5e. TASK NUMBER					
			5f. WORK UNIT NUMBER					
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> <b>Noblis,3150 Fairview Park Drive South,Falls Church,VA,22042-4504</b>			8. PERFORMING ORGANIZATION REPORT NUMBER					
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>			10. SPONSOR/MONITOR'S ACRONYM(S)					
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)					
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> <b>Approved for public release; distribution unlimited</b>								
<b>13. SUPPLEMENTARY NOTES</b>								
<b>14. ABSTRACT</b>								
<b>15. SUBJECT TERMS</b>								
<b>16. SECURITY CLASSIFICATION OF:</b> <table border="1"> <tr> <td>a. REPORT <b>unclassified</b></td> <td>b. ABSTRACT <b>unclassified</b></td> <td>c. THIS PAGE <b>unclassified</b></td> </tr> </table>			a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	<b>17. LIMITATION OF ABSTRACT</b> <b>Same as Report (SAR)</b>	<b>18. NUMBER OF PAGES</b> <b>32</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>						

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## List of Acronyms

<b>ADUSD(ESOH)</b>	Assistant Deputy Under Secretary of Defense (Environment, Safety, and Occupational Health)
<b>DAS</b>	Deputy Assistant Secretary
<b>DoD</b>	U.S. Department of Defense
<b>EE/CA</b>	Engineering Evaluation/Cost Analysis
<b>EMI</b>	Electromagnetic induction
<b>EPA</b>	Environmental Protection Agency
<b>ESTCP</b>	Environmental Security Technology Certification Program
<b>FS</b>	Feasibility Study
<b>FUDS</b>	Formerly Used Defense Sites
<b>ITRC</b>	Interstate Technology & Regulatory Council
<b>KBCRS</b>	Knowledge-Based Corporate Reporting System
<b>LiDAR</b>	Light Detection and Ranging
<b>MMRP</b>	Military Munitions Response Program
<b>MRS</b>	Munition Response Site
<b>NAOC</b>	National Association of Ordnance Contractors
<b>NFA</b>	No Further Action
<b>PM</b>	Project Manager
<b>RA</b>	Remedial Action
<b>RI</b>	Remedial Investigation
<b>SERDP</b>	Strategic Environmental Research and Development Program
<b>SI</b>	Site Investigation
<b>USACE</b>	U.S. Army Corps of Engineers
<b>UXO</b>	Unexploded ordnance
<b>WAA</b>	Wide Area Assessment

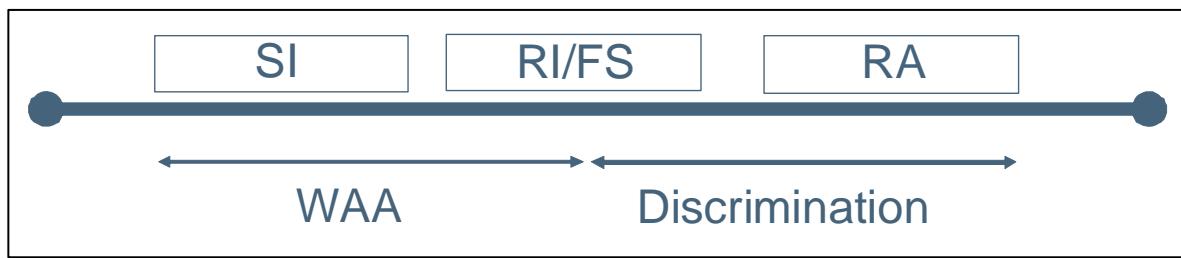
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# 1 Introduction

This report the findings and recommendations of a study, conducted for the Environmental Security Technology Certification Program (ESTCP) to identify potential barriers to the transfer of technologies—from the research and development phase to active field use—for munitions detection. To conduct a practical, focused assessment of barriers to technology transfer, the study focused on two specific emerging technologies: Wide Area Assessment (WAA) and unexploded ordnance (UXO) discrimination. This report discusses WAA; a parallel report on UXO discrimination is also available.

## 1.1 Background

The issue of UXO detection and remediation technology transfer barriers has been discussed for the last decade, perhaps most notably in the Final Report of the Defense Science Board Task Force on Unexploded Ordnance<sup>1</sup>. That report identified two changes that would bring about significant cost savings: use WAA to reduce the “footprint” of potential Munition Response Sites (MRSs) and use discrimination technologies to reduce the number of holes dug looking for munitions. Over the lifecycle of an environmental action starting with site investigation (SI) and working through remedial investigation/feasibility study (RI/FS) and remedial action (RA) towards site closure, WAA has applicability on the front end and UXO discrimination has applicability during the RA phases (see Figure 1).



**Figure 1. Applicability of WAA and Discrimination to Site Remediation Phases**

The need for cost-effective WAA methods and technologies is driven by the magnitude of the effort the Department of Defense (DoD) must undertake to clean up UXO on former and active DoD lands. The DoD must examine millions of acres of land potentially contaminated with UXO to identify areas that actually contain UXO for cleanup.

On much of the acreage—perhaps 80% or more—there are no UXO present; this area is “presumptively clean” and should be accepted as needing No Further Action (NFA) by all stakeholders. If an adequate process based on due-diligence were available to identify and verify the areas that are presumptively clean/NFA and safe for proposed future land use, most of the land could be removed from further analysis and returned to uses not restricted by munitions concerns. Developing and implementing a WAA process would allow the DoD to focus resources on those areas that contain UXO and present a safety hazard.

<sup>1</sup> *Report of the Defense Science Board Task Force on Unexploded Ordnance*, December 2003, Office of the Undersecretary for Acquisition, Technology, and Logistics, Washington, DC.

Substantial improvements have been made in technologies used to locate, characterize, and remediate UXO and munitions constituents on former military ranges. For a variety of reasons, these new technologies have not been adopted as rapidly in practice even though their use would decrease the total cost of clearance and improve the effectiveness of the clearance actions.

To that end, Mr. Alex Beehler, the Assistant Deputy Under Secretary of Defense (Environment, Safety, and Occupational Health) (ADUSD[ESOH]), directed the ESTCP to conduct a study to identify and examine potential barriers to UXO detection and remediation technology transfer. Mr. Beehler issued a memorandum on 23 December 2005 (the Directive), to the Deputy Assistant Secretary (DAS) of the Army (ESOH), the DAS of the Navy (Environment), the DAS of the Navy (Safety), the DAS of the Air Force (ESOH), and the Director of the Defense Logistics Agency requesting that they provide the necessary support to ESTCP to conduct this study.

The Strategic Environmental Research and Development Program (SERDP)/ESTCP initiated this study in June 2006 with issuance of a task order to Noblis to help establish a government steering committee and to provide technical support to the committee throughout its investigations, deliberations, and analysis of potential barriers to UXO technology transfer.

## 1.2 Report Organization

This report is divided into the following sections:

- Section 2—Objectives and Approach
- Section 3—UXO Wide Area Assessment Technology
- Section 4—Potential Market for WAA
- Section 5—Findings: Barriers to Increased use of WAA Technology
- Section 6—Recommendations
- Section 7—Conclusions

There are also two appendices:

- Appendix A—Memorandum from ADUSD(ESOH) Regarding Unexploded Ordnance (UXO) Technology Transfer Study
- Appendix B—WAA Briefing to the Steering Committee

## 2 Objectives and Approach

### 2.1 Study Objectives

The objective of the project was to conduct an independent study to identify and analyze the barriers to UXO detection and remediation technology transfer and, where possible, make recommendations for addressing such barriers.

Specifically, the study was conducted to accomplish the following:

- Identify and examine potential barriers to UXO detection and remediation technology transfer
- Identify potential government actions to overcome the barriers that would encourage and allow for the application of the latest UXO technologies throughout the lifecycle of UXO remediation
- Provide data on the technologies being used for current cleanup actions and, if appropriate, examine specific case studies to determine the drivers for technology selection

## **2.2 Approach**

To facilitate the study stated in the Directive, a steering committee was convened with representation from the Services and the U.S. Army Corps of Engineers (USACE)—Huntsville Center. This steering committee provided input and guidance during the study and, upon completion of the study, provided comments and recommendations.

The approach of the study included the following:

- Conducting interviews
- Assessing munitions detection technologies and current use
- Analyzing the potential market for munitions response technologies
- Reviewing policy, guidance, and requirements documents
- Providing recommendations and conclusions

To collect information to perform this study, Noblis performed the following:

- Conducted 30+ interviews with Army, Navy, and Air Force managers, technical support personnel, industry contractors, and National Association of Ordnance Contractors (NOAC) representatives
- Attended eight Military Munitions Response Program (MMRP)-related conferences, symposia, and MMRP Work Group meetings to obtain information on status of technology and its use in site munitions response actions
- Conducted analysis of the 2006 Defense Environmental Restoration Program Knowledge-Based Corporate Reporting System (KBCRS) MMRP dataset to assess potential market (site counts, size, characteristics, phase action timeframe, estimated costs)
- Reviewed several programmatic, guidance, and requirements documents to determine if language posed potential barriers to use of innovative technologies in the field
- Conducted case study reviews of selected field implementations
- Reviewed statements of work and performance work statements to assess the language of project requirements for contractors and whether there were potential barriers to use of innovative technologies in the field

Results from these efforts are discussed in the following sections.

## **3 UXO Wide Area Assessment Technology**

### **3.1 Technology Description**

WAA is a suite of technologies used to define the extent and characteristics of an MRS. WAA covers a variety of activities—generally referred to as a layered approach (see Figure 2)—to include high-airborne evaluation, which uses fixed-winged aircraft to survey up to thousands of acres per day. High-airborne evaluation can include the use of Light Detection and Ranging (LiDAR)—an optical remote-sensing technology that measures properties of scattered light to find range and other information of a distant target, which is the prevalent method to determine distance to an object or surface is to use laser pulses—and ortho-photography support. This approach is used to look for munitions-related features such as craters, which can then be evaluated by additional study.

## WAA Layered Concept



**Figure 2. WAA Layered Concept**

Low-airborne evaluation, a secondary level of evaluation, is conducted at a lower altitude, often by helicopter. This technology is limited to hundreds of acres per day due to the need for closer ground survey. Magnetometry is the primary detection tool used for low-airborne surveys. Vegetative ground cover can limit the effectiveness of low airborne evaluation, particularly in areas of thick brush or woods.

Finally, ground-level surveys may be done using magnetometry and electromagnetic induction (EMI) to identify specific locations of munitions material. The ground-level surveys would generally be conducted in areas where positive signs of munitions were detected by high-airborne and low-airborne surveys. Ground-level surveys using statistical methods are also critical in confirming presumptively clean areas.

The overarching applications of WAA and what is expected and not expected of this suite of technologies are listed in Table 1. These technologies are considered proven and are commercially available. Fairly accurately field-use costs can be estimated on an acreage basis.

### 3.2 Current Usage

The Services are committed to meeting the DoD goal of completing SIs for all sites by 2010. The Air Force is currently completing WAA at all applicable sites in order to establish a baseline of site data to guide and scope the RI. The Navy has few MMRP sites on land; the Navy's underwater WAA efforts are not included in this analysis because the application of airborne WAA to underwater sites is limited. The Army has an extensive program to complete SIs based on historical record searches and completion of MRS Prioritization Protocol scores. Similarly, the USACE views WAA as an important tool for establishing the nature and extent of munitions during the RI phase.

**Table 1: Applications of WAA**

<b>WAA does support:</b>	<b>WAA is not intended to replace:</b>
<ul style="list-style-type: none"><li>• Identifying potential MRS boundary</li><li>• Discovery of previously unknown MRS</li><li>• Identifying areas of no evidence of munitions activities</li><li>• NFA decisions</li><li>• Reconciling historical information</li><li>• Characterizes follow-on investigation areas by<ul style="list-style-type: none"><li>– Slope</li><li>– Vegetation</li><li>– Buildings</li><li>– Density of anomalies</li></ul></li><li>• Improved remedial cost estimates</li><li>• Risk-based decision-making and prioritization (e.g., selection of alternatives, design of munitions response)</li><li>• Record of Decisions</li></ul>	<ul style="list-style-type: none"><li>• Final remedial action work plans</li><li>• Detailed anomaly identification<ul style="list-style-type: none"><li>– Dig lists</li></ul></li></ul>

This study found that the WAA technologies are mature and commercially available. They have been successfully field-tested and have been applied operationally. Furthermore, field-use costs are known and reasonable. Through the efforts of the Interstate Technology & Regulatory Council (ITRC) and the publication of WAA field data from Air Force sites and SERDP/ESTCP demonstrations, regulatory acceptance of WAA field data is increasing. Although significant progress has been made regarding regulatory acceptance, knowledge among the broad regulatory community is still limited. Based on their experience, the Services have found that educating the stakeholders about the capabilities and limits of WAA is critical to gaining site-specific acceptance. NFA decisions remain site-specific and require ground verification (often extensive).

## 4 Potential Market for WAA

The potential market for WAA was estimated by analyzing data in the KBCRS—a relational database containing detailed information on DoD environmental programs. Sites suitable for WAA was defined as firing or bombing ranges that have the investigation phases programmed for out-year requirements (referred to as “Site Type 1” in this study). Several KBCRS range types met the definition of a firing or bombing range based on usage patterns, expected ordnance type, and so forth. For example, firing ranges, multi-use ranges, and air-to-land ranges were included; pistol ranges, disposal pits, and dry wells were excluded. Likewise, the “phase” category in this study grouped related phases within KBCRS, such as RI/FS and engineering evaluation/cost analysis (EE/CA). A minimum site size of 1,000 acres was used for this analysis to eliminate those sites where the mobilization costs could outweigh benefits. WAA may be cost-effective at smaller sites if these sites are geographically close together to allow for a single mobilization of the WAA technologies. KBCRS contains a sufficient number of data fields and descriptors allowing for the data to be parsed using those parameters for this analysis. Figure 2 summarizes the potential market by identifying sites and acreage reflecting the potential WAA market. Overall, the vast majority of MMRP site acreage is potentially favorable to WAA. Approximately 98% of the area is clustered in 465 sites, each containing over 1,000 acres. Furthermore, approximately 51% of the

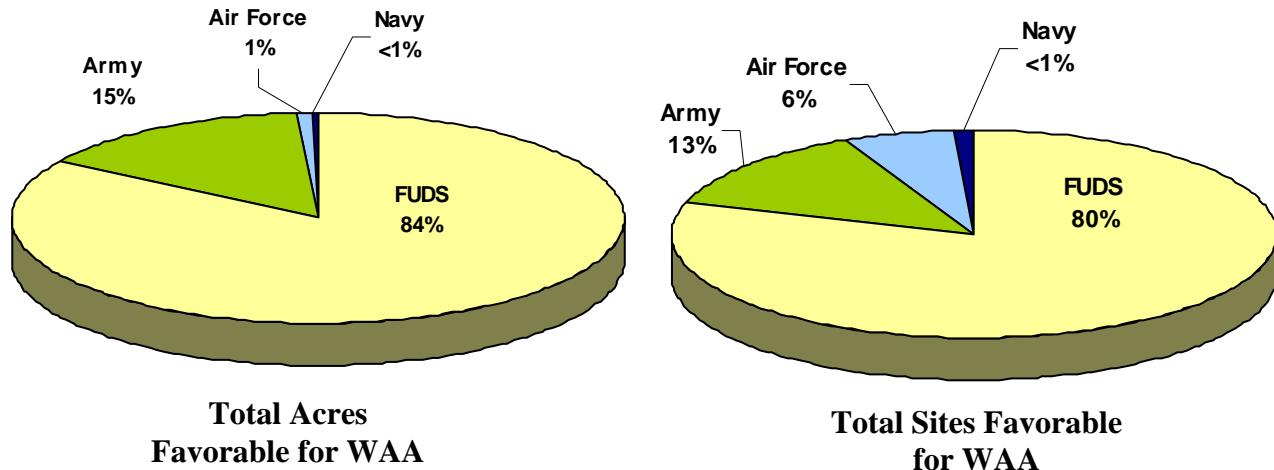
area identified has favorable terrain and vegetative cover for low-airborne application. Acknowledging that the KBCRS data contains some inaccuracies, the sheer potential market size makes any inaccuracies in the data inconsequential to this analysis.

Table 2 shows the potential market for WAA by Service, number of sites, and acreage per Service—this data includes Formerly Used Defense Sites (FUDS), which clearly drives the market in both number of sites and total acreage (see Table 2).

**Table 2: Potential Market for WAA**

Component	Number of Sites	Total Acreage
FUDS	376	14,762,517
Army	59	2,573,917
Air Force	26	149,136
Navy	4	43,373
Total	465	17,528,943

The Air Force is aggressively using WAA for SI-like actions, but Air Force sites account for only about 10% of the overall number of sites (all sites, not just 1,000+-acre sites). Because most Navy land sites are much smaller than the other Services, very few are favorable for WAA. There are 162 Navy sites, totaling about 49,000 acres (all sites, not just 1,000+-acre sites). Only 4 sites are over 1,000 acres, and they account for 80% of the Navy's site acreage (see Figure 3).

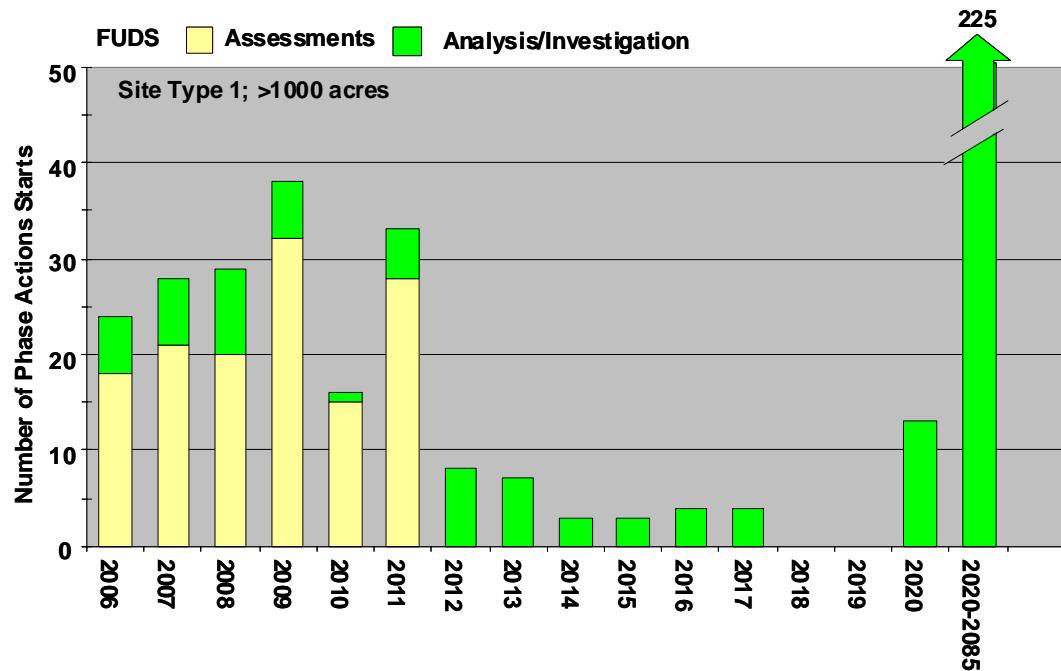


**Figure 3. Analysis of WAA Market**

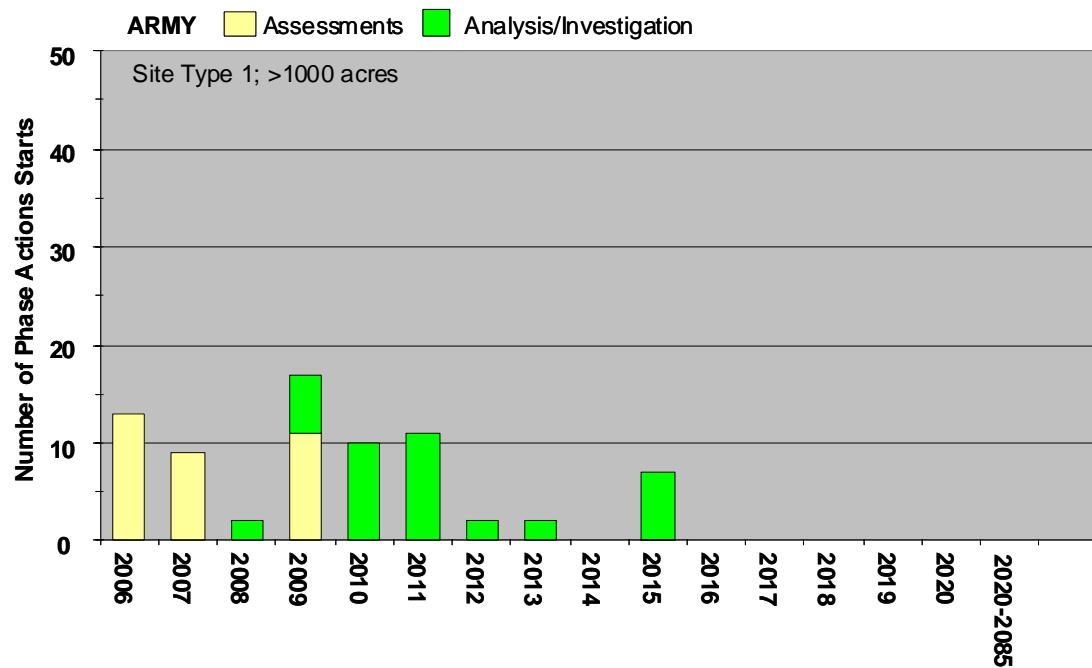
While the Army has in excess of 2.5 million acres favorable for WAA, there is no current use of WAA and no near-term plans because the Army is focusing on completing SIs. The DoD goal for SI completion in 2010 is to limit—now and in the future—the use of WAA as an option for the Army's MRSs suitable for its application.

The largest number of phase actions appropriate for WAA are RIs (or equivalent). RIs—especially for FUDS—extend far into the future. The FUDS program accounts for about 78% of all SI and RI phase actions (see Figure 4). The Army is the second largest group comprising 13%

of SI and RI phase actions. The Army's last SIs start in 2009, and RIs will continue to start until 2015 (see Figure 5). Figures 4 and 5 show SI data as the yellow "Assessments" bars and RI data as the green "Analysis/Investigation" bars.



**Figure 4. FUDS Phase Action Counts**



**Figure 5. Army Phase Action Counts**

## 5 Findings: Barriers to Increased Use of WAA Technology

The DoD has been investigating the policy and technology needs for WAA concurrently for several years. The policy need was identified in the study by a Defense Science Board Task Force that studied how technology could help reduce the cost of UXO cleanup. Subsequent DoD efforts examined what the policy should be and how such a policy might be implemented.<sup>2,3</sup> Technologies that could be applied to the problem were being investigated by the DoD—even before the Defense Science Board Task Force study was conducted—and have continued as the DoD focused more intently on the issue.

This study identified three key barriers that limit the wide-scale application of WAA technologies:

- Regulatory acceptance is still developing.
- There are no programmatic drivers/metrics.
  - Current DoD SI metrics dictate Army and FUDS focus.
  - Funding is not structured to implement efficient WAA program.
- Project Manager (PM) Guidance document on WAA use is not available.

The first barrier is that not all regulatory agencies are familiar with WAA approaches, so their acceptance is often limited and conditional. It is important to have regular and productive interactions with appropriate agency personnel to establish understanding and trust in WAA technologies and the data resulting from their use. The ITRC is currently the most active forum for this training, interaction, and acceptance. Ultimately, a more formal regulatory agreement would be desirable. However, with the collapse of the DoD/Environmental Protection Agency (EPA)/State Munitions Response Committee, no such forum is currently active.

The second identified barrier—the lack of formal programmatic planning and funding across the DoD—needs to be addressed before a consistent WAA approach can be developed and implemented. The extensive Army and FUDS programs have been managed to efficiently meet the DoD's SI goals. The PMs do not have the flexibility they need to implement any innovative approaches, including WAA.

Finally, there are no PM Guidance documents available for use with WAA technology. Currently, the availability of WAA technologies is known, but formal guidance has not been developed. Because of the focus on SI goals discussed above, the lack of guidance has only added to the limited use of WAA. In the future, it will be critical to develop guidance to provide the PMs with clear procedures on when and how to apply WAA technologies.

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<sup>2</sup>*Response to Defense Science Board UXO Task Force's Recommendations, 25 May 2005*, Memorandum for ADUSD(ESOH), from Operational and Environmental Executive Steering Committee For Munitions, Munitions Response Subcommittee, Department of the Army, Office of the Assistant Secretary of the Army, Installations and Environment, Washington, D.C.

<sup>3</sup>*White Paper, MMRP Footprint Reduction Strategy*, Draft for MRC Workgroup Review, 15 June 2005.

## **6 Recommendations**

The results of this study support three main recommendations: support a regulatory acceptance process, establish a WAA programmatic metric, and prepare DoD policy implementation guidance.

### **6.1 Regulatory Acceptance Process**

In order for WAA data to support footprint reduction, NFA decisions, site-specific investigation, and remedial decisions, it is critical for this technology to gain regulatory acceptance and to formalize the regulatory basis for NFA decisions.

Currently, the most active regulatory interactions are with the ITRC. The DoD should continue to support the ITRC in the preparation of a WAA Technical Regulatory Guidance document. This document would define the WAA concept at the state level, would support state acceptance of the WAA process to identify presumptively clean areas, and would help ensure uniform implementation of the WAA process. A WAA Technical Regulatory Guidance document would develop a consistent, defensible process to differentiate areas that present unacceptable explosives hazards from those that do not.

The DoD should establish a forum for developing and gaining acceptance of a DoD/regulatory consensus approach to making NFA decisions. The consensus documents would establish uniform approaches by the Services, within the EPA Regions, and across the states.

### **6.2 Establish WAA Programmatic Metric**

Establishing WAA programmatic metrics that are focused on implementing WAA as a Strategic Plan metric goal will support the Services in managing their programs with footprint reduction as an overarching objective. The DoD should establish a goal that the Services complete WAA surveys of all appropriate areas by an established date (as early as FY2012). The programmatic metric should establish the requirement of a consistent approach by region or by USACE District. The benefits of establishing clear goals include allowing the Services to plan their WAA assessment projects from start to finish, prepare a budget for the entire WAA activity, contract efficiently and cost-effectively by covering all sites within a USACE District, and adapt as needed to changing conditions as the project proceeds.

The results of complete WAA application to suitable sites will be the delineation of target areas and identification of areas without munitions features—the first step in establishing presumptively clean areas. The WAA data will then support the following:

- Defensible Conceptual Site Models, which will be used for site planning of further investigations
- More defined and defensible cost estimates for site cleanup
- The prioritization of sites based on risk and potential NFA decisions
- The selection of suitable subsequent technologies to complete the investigation and plan for remediation.

These programmatic metrics are the key steps to achieving the goal of footprint reduction, which will quickly return land to beneficial use. A specific proposed metric is provided in Table 3.

**Table 3: Proposed WAA Programmatic Metric**

• Proposed DoD Strategic Plan Metrics
– Complete WAA at all applicable sites by FY## (Consistent with the upcoming RI/FS metric)
– Define procedures and identify appropriate MRS by FY09
• Establish, with federal and state regulatory agencies, a process for using WAA in munitions response process by FY10
– Establish DoD/regulatory consensus approach to making NFA decisions
– Design and implement a WAA process to identify presumptively clean areas, plan future investigations, and improve cost estimates

### **6.3 DOD Policy Guidance**

This study recommends the development of a Technical Guidance Manual (Air Force and USACE) that defines the WAA process and matches the WAA technology suite with site characteristics and study goals. The manual would define a WAA process that would build lines of evidence for presumptively clean areas and regulatory agreement and would require an adequate due-diligence component to gain regulatory acceptance. The manual would also define a process to provide data to support the next steps for identified MRSs and develop information for improving cost estimates.

## **7 Conclusions**

WAA consists of the application of several proven technologies to generate efficiencies in the detection of munition materials across military ranges. It relies on a three-part strategy that includes high-airborne evaluation, low-airborne evaluation, and ground-level surveys. These technologies are mature, implementable, and commercially available.

There are several issues (barriers) limiting the application of WAA. These barriers include a limited understanding and acceptance of WAA within the regulatory community. In addition, there is a lack of program-wide strategy, planning, and funding for WAA, and there is no formal guidance available for use across DoD sites. It is recommended that the DoD develop a consistent programmatic approach to address these barriers as part of their objective of implementing this technology at ranges across the country.

This study has identified a concerted effort by many dedicated professionals to accomplish the goals of the Defense Science Board's report. Diligent technical work, resourceful program management, policy development, and regulatory outreach have been exhibited by every Service in order to achieve the cost savings promised by footprint reduction, and significant accomplishments have been made. By compiling and promoting the progress of these efforts, it may be possible to overcome the final barriers to the implementation of WAA technologies and achieve the universally accepted goal of footprint reduction.

## Appendix A—Memorandum from ADUSD(ESOH) Regarding Unexploded Ordnance (UXO) Technology Transfer Study



OFFICE OF THE UNDER SECRETARY OF DEFENSE  
3000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3000

ACQUISITION  
TECHNOLOGY  
AND LOGISTICS

DEC 23 2005

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY OF THE ARMY  
(ENVIRONMENT, SAFETY, AND OCCUPATIONAL HEALTH)  
DEPUTY ASSISTANT SECRETARY OF THE NAVY  
(ENVIRONMENT)  
DEPUTY ASSISTANT SECRETARY OF THE NAVY  
(SAFETY)  
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE  
(ENVIRONMENT, SAFETY, AND OCCUPATIONAL HEALTH)  
DIRECTOR, DEFENSE LOGISTICS AGENCY

SUBJECT: Unexploded Ordnance (UXO) Technology Transfer Study

I have directed the Environmental Security Technology Certification Program (ESTCP) to conduct a study that identifies and examines potential barriers to Unexploded Ordnance (UXO) technology transfer. The Department continues to invest precious funding to develop new technologies that improve our Military Munitions Response Program. Emerging technologies offer the potential to rapidly expedite UXO detection and remediation, and save the Department considerable resources. These savings, however, will only occur if advanced technologies, when proven to be effective, are employed in actual UXO cleanup.

I request you support this important study by identifying an appropriate member of your staff to serve as your representative and to provide ESTCP with the data they will be requesting to analyze this issue. Please provide Dr. Jeffrey Marqusee (703-696-2126; Jeffrey.Marqusee@osd.mil) with your point of contact by January 18, 2006.

*Alex A. Bechler*

Alex A. Bechler  
Assistant Deputy Under Secretary of Defense  
(Environment, Safety & Occupational Health)



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## Appendix B—WAA Briefing to the Steering Committee

### Identification of Barriers to Munitions Response Technology Transfer

### Conducting Wide-Area Assessments

Presented to: UXO Technology Transfer Study Steering Committee  
on 30 January 2008

Revision Date: 17 April 2008



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### Overview

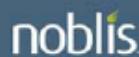
- Define Technology
- Estimate Market Size (Overall and Service-specific)
- State of Technology
- Current Usage
- Barriers to Increased Usage
- Recommendations



2

## Wide Area Assessment Technology

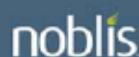
### WAA Layered Concept



3

## Wide Area Assessment Technology

- Wide Area Assessment is a suite of technologies to define the extent and characteristics of a munitions response site (MRS)
- Innovative Technologies Under Discussion
  - High Airborne
  - Low Airborne
  - Statistical Tools



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## Wide Area Assessment Technology

- WAA does support:
  - Identify and bound potential MRS boundary
  - Discovery of previously unknown MRS
  - Identifying areas of no evidence of munitions activities
    - No further actions decisions
  - Reconcile historical information
  - Characterizes follow-on investigation areas by
    - Slope
    - Vegetation
    - Buildings
    - Density of anomalies
  - Improved remedial cost estimates
  - Risk base decision making and prioritization (e.g., selection of alternatives, design of munitions response)
  - Record of Decisions



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## Wide Area Assessment Technology

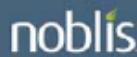
- WAA is not intended to replace:
  - Final remedial action work plans
  - Detailed anomaly identification
    - Dig lists



6

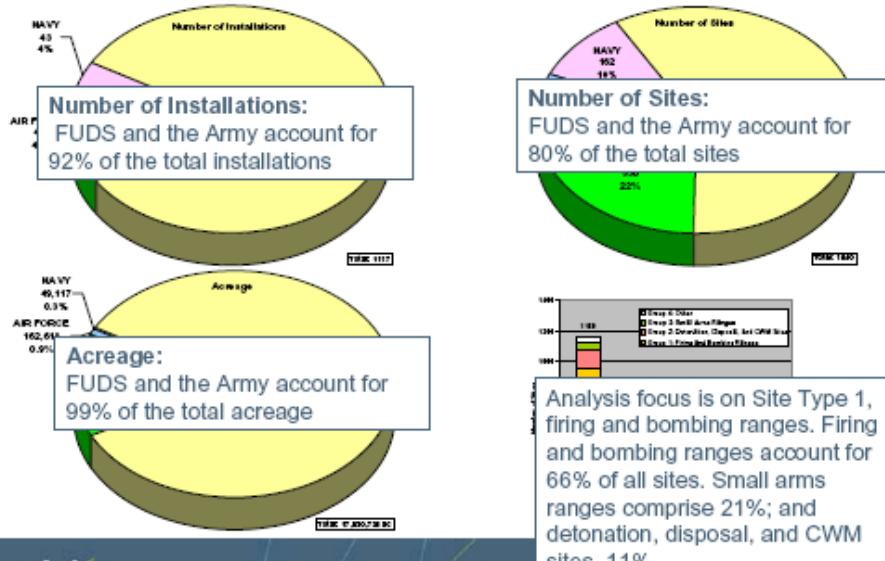
## MRS Potentially Suitable for WAA-“WAA Market” (Overall and Service-specific)

- The KCBRS was evaluated to get a sense of the potential WAA Market
- KBCRS data elements evaluated (DOD overall and Service-specific):
  - Site counts
  - Site acreage
  - Phase actions (Types and Schedule)
  - Programmed budget and CTC
- WAA is most suitable for these KBCRS site types:
  - Firing Ranges, Unexploded Munitions and military munitions Areas, Unknown Site Type, Multi-Use Range, Air-to-Land, others (see detailed analysis) Sites with these characteristics are referred to in this briefing as Type 1 sites.
- WAA is generally cost effective for MRS over 1,000 acres (Bundling geographically proximal sites may significantly increase the market size)



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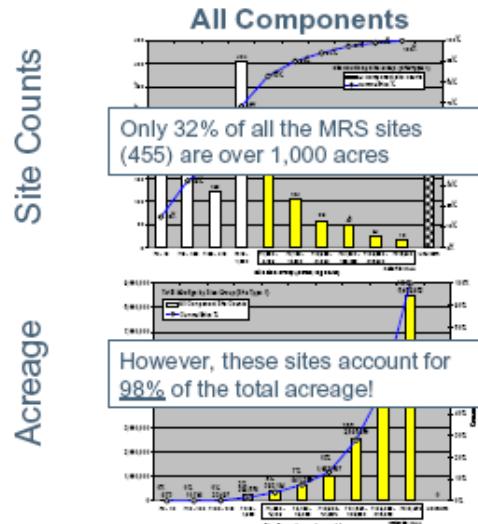
## WAA Market Number of MRS Sites and Total Acreage (Site Type: 1)



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## Potential WAA Market

### Site Counts and Acreage by Size Group

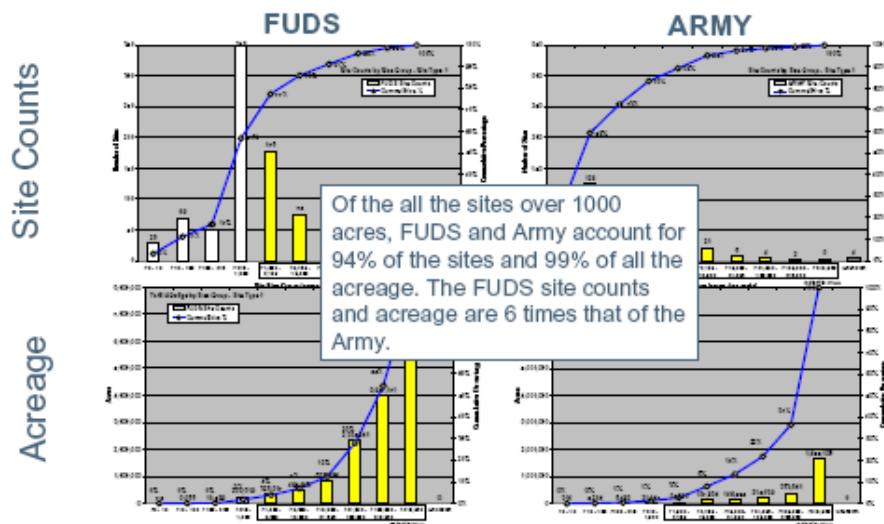


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## Potential WAA Market

### Site Counts and Acreage by Size Group

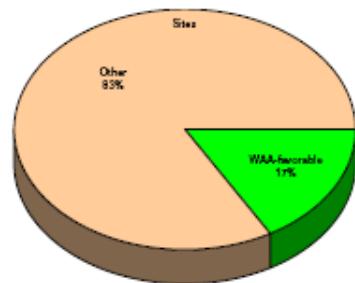


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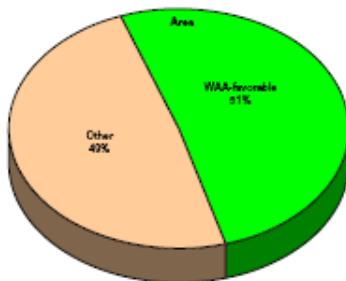
10

## Potential WAA Market

Sites and Acreage with WAA-Favorable Terrain and Vegetative Cover (>1000 acres; Site Type 1; All Components)



Terrain	Vegetative Cover
Flat	Barren or low grass
Flat with gorges or gullies	Low grass and few shrubs
Gently rolling	Shrubs and some trees
Rolling with gorges or gullies	Heavy grass and many shrubs
Heavily rolling	Heavy shrubs and trees
Mountainous	Heavily wooded
Water	Water
Unknown	



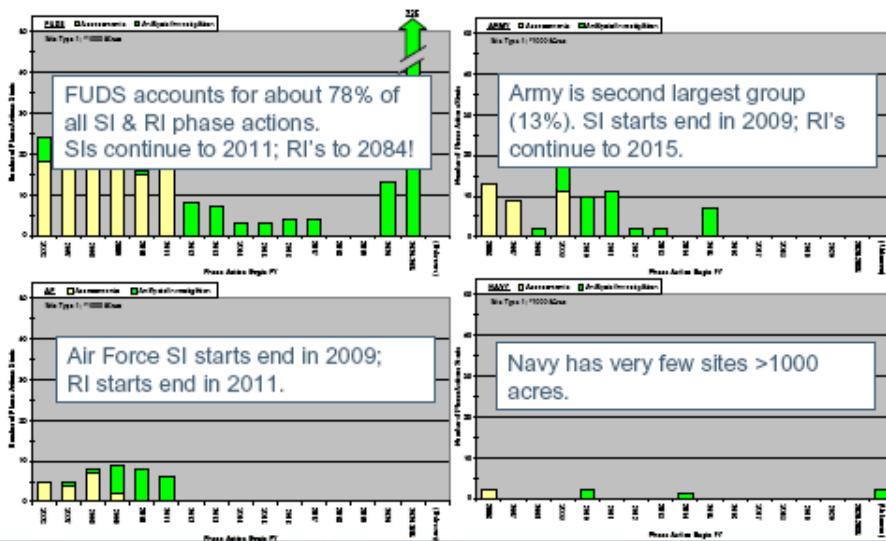
Using a fairly conservative selection of terrain and vegetative cover classifications, about 51% of the site acreage is potentially favorable to WAA. However, this does not take into account level of site development or private property access restrictions.

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## Potential WAA Market

Site SI & RI Phase Action Counts by FY (Site Type 1)



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## Potential WAA Market - Conclusions

- Overall, the vast majority of MRS acreage is potentially favorable to WAA
  - 98% of area is clustered in 455 sites with over 1000 acres (32% of the sites)
  - 51% or more of the area has favorable terrain and vegetative cover (important for low airborne)
- FUDS sites represent the largest market, by far (94% of sites; 99% of acreage)
- The DoD goal for SI completion is 2010 – limiting the use of WAA as an option of the Army's use at MRS that are suitable for its application
- As a result, the largest number of potential phase actions likely to use WAA would have to be RIs (or equivalent). RIs (especially for FUDS) extend far into the future.
- The Air Force is aggressively using WAA for SI-like actions, but Air Force sites account for only about 10% of the overall number of sites (all, not just 1000+ acre)
- Because most Navy (land) sites are much smaller than other Services, very few are favorable for WAA. 162 Navy sites total only about 49,000 acres. Only 4 sites are over 1000 acres (although they account for 80% of the site acreage).



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## State of WAA Technology

- Technologies mature and commercially available
- Technologies have been field-tested successfully
- Field-use costs are known and reasonable
- Technologies have been applied operationally
- Regulators learning to accept results
  - Knowledge among broad regulatory community is limited
    - Education is the issue not acceptance
- No Further Action decisions are site specific and require ground verification



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## State of Technology

Technology		Applicability	Maturity
High Airborne Remote Sensing	Orthophotography		Established
	LiDAR		Established
	Limited topography and vegetation cover. It detects medium to large military munitions.		Established
Low Airborne Geophysical Sensing	HeliMAG		Established
	Next Generation HeliMAG (for example, ultralight)		Emerging
Ground Based Geophysical Sensing	Using appropriate systems, applicable to almost all sites. Detects small to large munitions.		
	Single-Sensor (EMI or Mag)		Established
	Multisensor (EMI + Mag or other combinations)		Emerging
	Hand-held		Established



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## State of Technology

Technology		Applicability	Maturity
Software	VSP	Statistical methods and tools for UXO characterization and mapping using an optimal survey scheme that ensures a high probability of detecting a target area of a specified size, shape, and anomaly density of concern.	Innovative
	GIS	Supports standardized integration of sensor results with base-mapping and archival information.	Established
	Site Suitability Modeling	Uses LiDAR to establish areas by slope, vegetation, and buildings to define appropriate follow-on investigation technologies.	Innovative



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## Current Usage (what are people doing right now?)

- Air Force: Currently completing WAA at all applicable sites (high Airborne is done, low airborne underway)
- Navy: Few land sites (underwater WAA not included in this analysis)
- Army: SIs focused on historical records search and completion of MRSPP scores
- FUDS: USACE view of wide area assessment as more appropriate for nature and extent (RI) not the SI phase  
(Betina Johnson, Program Manager, US Army Corps of Engineers, Huntsville Center, 2007 UXO Forum)

## Barriers to Increased Usage of WAA

- Lack of programmatic driver/metric
  - Current DoD SI metrics dictate Army and FUDS focus
  - Funding not structured to implement efficient WAA program
- Project manager guidance document on WAA use not available
- Regulatory acceptance is still developing

## Potential Barriers

- Technology
- Project Management
- Contracting/PBC
- Risk / Regulatory
- *Programmatic*



## Potential barriers to acceptance and implementation of WAA innovative technologies by users, regulators, and stakeholders

- **Technology**
  - State of Development/Maturity
  - Level of demonstration/validation (field demos to production usage)
  - Commercial availability (vendors or contractors)
  - Complexity / User skill level requirements
  - Applicability
- **Costs vs. Benefits**
  - Dollars (upfront costs vs. reduced costs later)
  - Time (upfront time lags vs. improved efficiency later)
  - Results
- **User Knowledge and Understanding**
  - Available communication channels
  - Access to knowledge
  - Is the technology understandable to non-geophysicist ?
  - Any misinterpretation/misunderstandings prevalent?
- **Acceptance – Users and Regulators**
  - Perceived or actual risk
  - Confidence in performance
  - Willingness to try

## Potential barriers to acceptance and implementation of innovative technologies by users, regulators, and stakeholders (Concluded)

- Policy, Programmatic, and Management Issues
  - Structuring of funding (piecemeal approach)
  - Lack of policy
  - National vs. installation level approach
- Contracting Issues
  - PBC
    - Control of project (technology selection)
    - Project risk
  - Funding availability
  - Contractor availability
  - Potential need for sole-source contract
  - Need for non-standard contracting approaches
- Regulations/Requirements
  - Prohibit use
  - Favor other technologies
  - Increase effort to implement



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## Recommendations on WAA

Establish:

1. WAA Programmatic Metric
  - Establish Goals in the DoD Environmental Strategic Plan (to be updated in 2009) and DERP Management Guidance
2. Regulatory Acceptance Process
  - Engage with stakeholders to establish acceptance of data
  - Education process is the key
3. DOD Policy Guidance

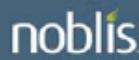


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## Recommendations on WAA

### 1. Establish WAA Programmatic Metric

- Majority of MRS, including FUDS, and of MRS suitable for use of WAA are Army's responsibility
  - Current SI metric doesn't allow or require WAA at applicable MRS within funding and schedule constraints
  - OSD needs to provide program direction for use of WAA
    - Change the Strategic Plan

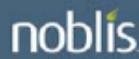


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## Recommendation on WAA:

### 1. Establish WAA Programmatic Metric

- Establish DOD Metrics Focused on WAA Assessment
  - Process
    - Establish wide-area assessment as a Strategic Plan Metric
  - Goal
    - WAA survey of all appropriate areas in a timely manner by FYXX
    - Consistent approach by region or District
  - Benefits
    - Can plan start to finish
    - Can budget for entire activity
    - Can contract efficiently and cost-effectively
    - Can adapt as needed to changed conditions as project proceeds
  - Results
    - Delineation of target areas
    - Define areas without munitions features - presumptively clean areas
    - Defensible CSM
    - Use for
      - Site planning
      - Cost estimates
      - Prioritization
      - Suitability of subsequent technologies



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## Recommendations on WAA

### 1. Establish WAA Programmatic Metric

- *Proposed DoD Strategic Plan Metrics*
  - Complete WAA at all applicable sites by FYXX  
*(Consistent with the upcoming RI/FS metric)*
    - Define procedures and identify appropriate MRS by FY09
  - Establish, with federal and state regulatory agencies, process for using WAA in munitions response process FY10
    - Establish DoD/Regulatory Consensus Approach to Making No Further Actions Decisions
    - Design and implement a wide-area assessment process to identify presumptively clean areas, plan future investigations, and improve cost estimates



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## Recommendation on WAA:

### 2. Regulatory Acceptance Process

- Support ITRC to prepare a Wide-Area Assessment Technical Regulatory Guidance Document
  - Defines concept at state level
  - Supports state acceptance of process to specify presumptively clean areas
  - Helps ensure uniform implementation of process
- Establish DoD/Regulatory Consensus Approach to Making No Further Actions Decisions
  - Service-specific (Army, FUDS, Navy, AF) and at DOD level – Need uniform approach with EPA and states
  - Should be at working level where everyone agrees



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## **Recommendation on WAA:**

### **3. DOD Policy Guidance**

- Define a wide-area assessment process
- Directs preparation of Technical Guidance Manual
  - Match Technology Suite with Site Characteristics and Study Goals
  - Build lines of evidence for presumptively clean areas and regulatory agreement
    - Will require adequate due-diligence component to gain regulator acceptance
  - Provide data to support next steps for identified military response sites
  - Develop information for improve cost estimates



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